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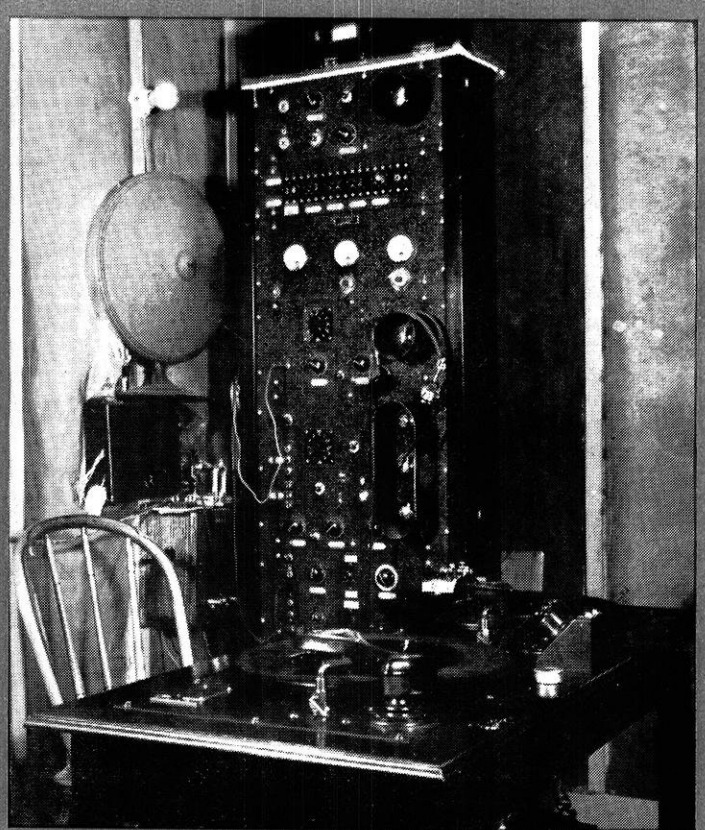
THE WISCONSIN ENGINEER

..IN THIS ISSUE..

WHA

Rural Electrification

Locomotive Construction



NOVEMBER **1936**

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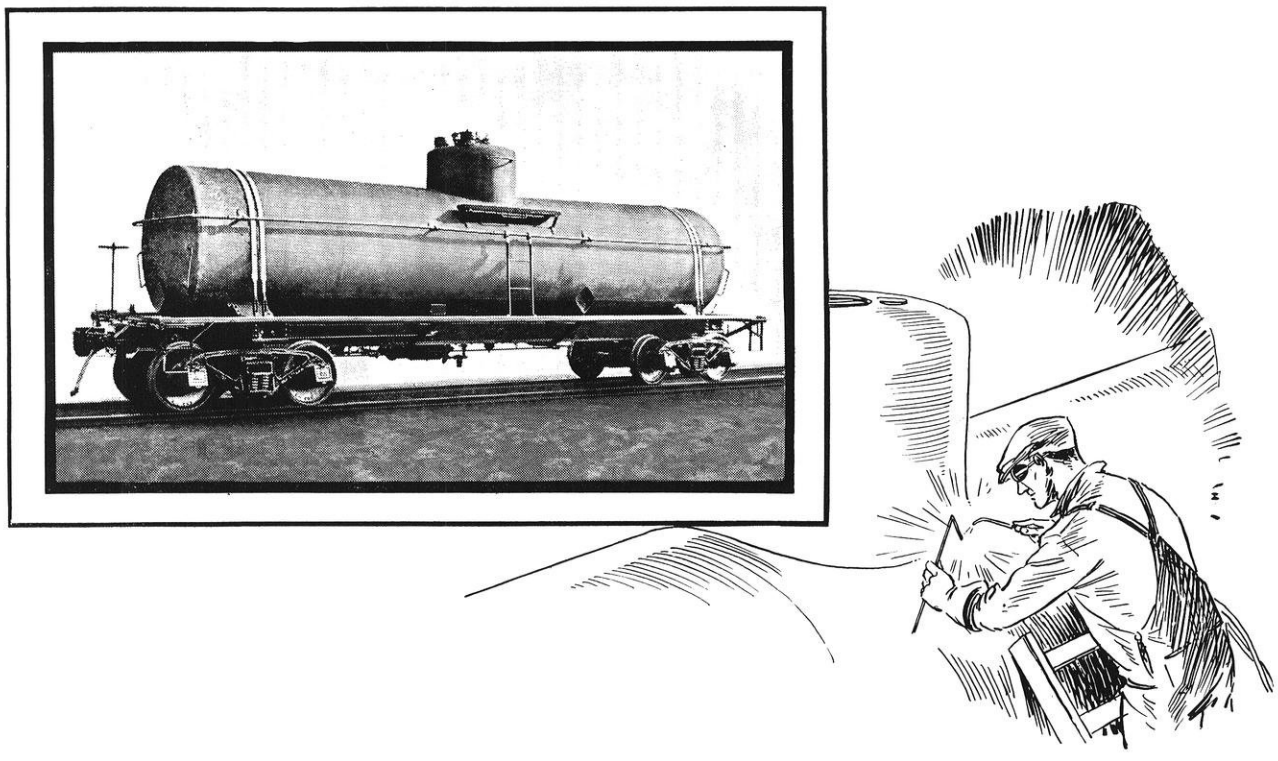

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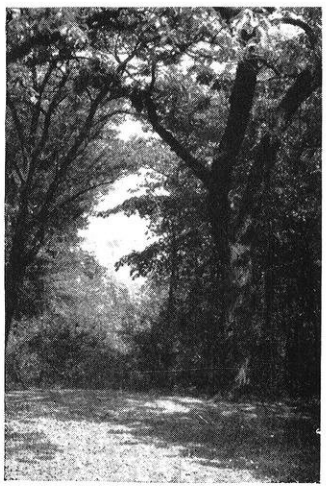

Along the Lake Road

WITH THE CONTRIBUTORS . . .

- Our front cover shows the old control equipment of WHA when the whole set-up was located in one room in Sterling Hall. You'll want to find out more about the history of WHA and how they have developed in the last twenty years. See the lead article beginning on page 23.

- Last year's editor, Leo Nikora, is back again with another bit of advice. See what he has to say on pages 26 and 27.

- The REA is constructing lots of rural high lines in Wisconsin. See page 28.

- Look on page 34 and you'll see what your student society has been doing lately.

- Maurice Swanson, m'36, tells how locomotives are being made bigger and better on page 36.

- See Hugh Wright's drawing on page 39 that placed second in the national S. P. E. E. drawing contest.

The Wisconsin Engineer

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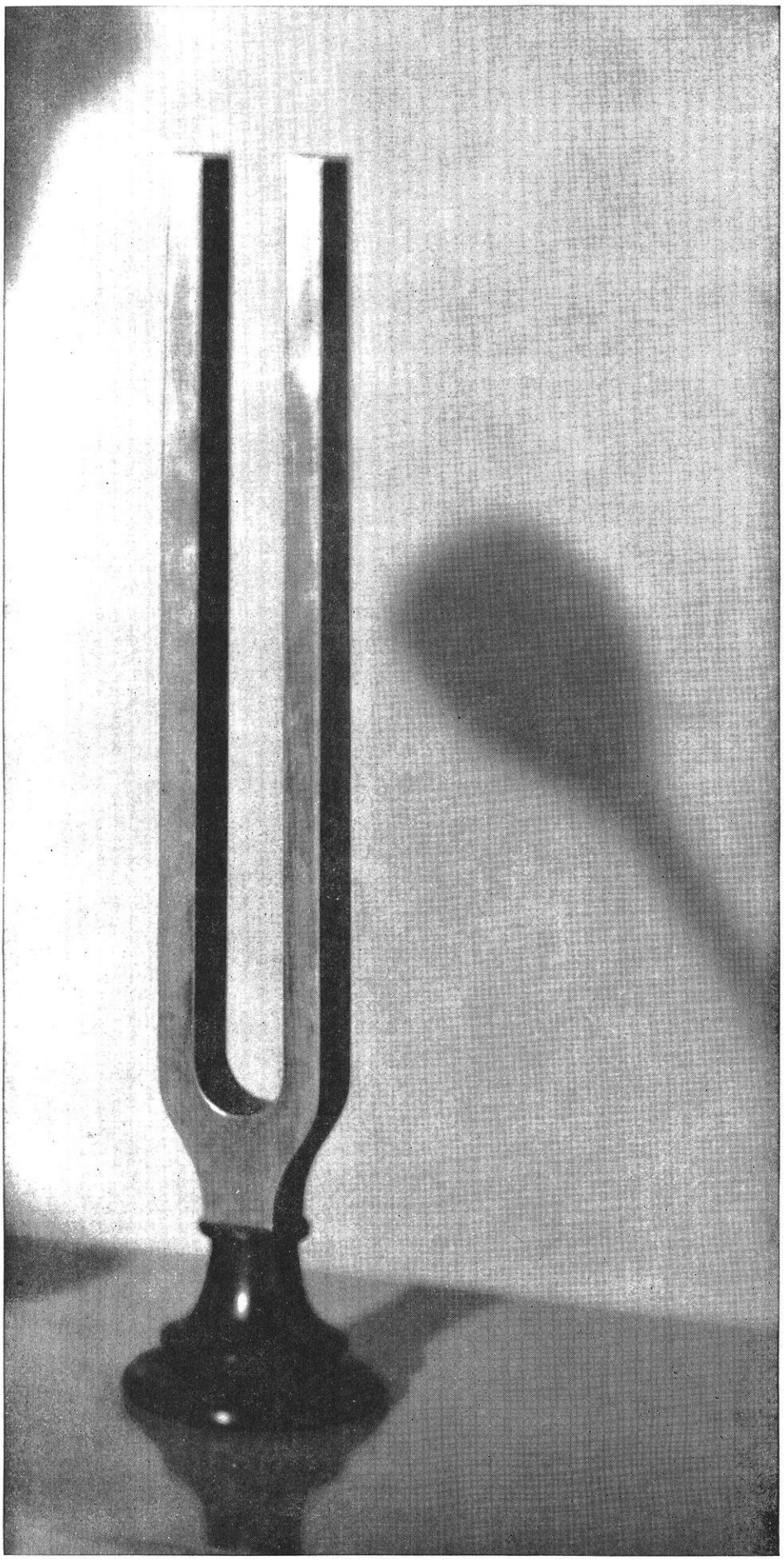

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The
symbol of
ACOUSTICAL
ENGINEERING

WHA—LEADER in the Technical Development of Broadcasting

by **A. L. BELL, e'31**

Studio Operator, State Station WHA

VARIOUS inventors and groups of experimenters contributed to the development of the art of radio telephony, and its application to the concept of broadcasting. One such group, working at the University of Wisconsin carried on an important share of this pioneering work. In fact, the work of this group preceded that of stations generally regarded as being pioneer broadcasters. It is the purpose of this article to review these early developments and to describe the subsequent steps in the establishment of the present WHA.

The earliest experiments in wireless telegraphy at the University of Wisconsin were carried on by Prof. Edward Bennett in 1909. Later Prof. E. M. Terry collaborated in this work and by 1915 had an experimental transmitter 9XM in operation in the basement of Science Hall, where the Physics Department was then located. Aside from its experimental uses, 9XM served to transmit radio telegraph weather reports. It operated on a wave length of about 750 meters. An improved 5 kilowatt spark transmitter was constructed during that year and by June, 1916, was put in operation on about 425 meters. A regular schedule of weather forecast transmissions for the benefit of farmers was established that year.

Turning to the field of radio telephony, the workers were faced with the problem of securing suitable transmitting tubes. None were available commercially, so under Professor Terry's direction many experimental tubes were constructed. The first ones were unsatisfactory since the technique of blowing, pumping, and de-gassing had to be worked out. Their life was short, sometimes only a few hours, and the early station often was forced off the air while tubes were replaced. To maintain its operating schedule, the engineers many times had to work through the night preparing tubes for the next day's broadcast. Incidentally, many of these tubes have been preserved and a display of them has been arranged at the present home of WHA. The display shows clearly the steps of improvement from the first crude attempts to the more efficient and powerful types.

By the early part of 1917 the experimenters had constructed enough of their experimental tubes to carry on their radio telephonic work. Although the early attempts resulted only in badly distorted reproductions, improvements were made, and within a few months fairly successful transmission of music and speech was accomplished.

With the entrance of the United States into the World War, radio equipment in general was ordered dismantled, but 9XM, along with certain other stations, was allowed to continue its operation as a service to the nation. The efforts of the station were diverted, however, from radio telephony development to the immediate problem of training wireless operators for service in the Navy. This work was continued extensively through 1918. In that year also, the towers behind Sterling Hall were constructed.

Many workers contributed to the development of the experimental station. Along with Professor Terry were such men as Malcolm P. Hanson, later chief radio engineer for Admiral Byrd on his first Antarctic expedition, C. M. Jansky, Jr., radio engineer, and G. R. Greenslade. These men, and others associated with them, were true pioneers in the development of broadcasting at the University of Wisconsin.

At the close of the war, attention was again turned to the problem of radio telephony, and by February, 1919, scheduled speech transmissions were being held between 9XM and the Great Lakes Naval Training Station. Distortion of the transmitted speech was the principal problem of the experimenters. Many experimental conversa-

Radio Hall Reception Room

tions were held, and gradually the various causes of this distortion were located and eliminated.

Exactly when the conception of broadcasting, as we now know it, became apparent to the experimenters it is difficult to say. It has been pointed out that the radio telegraph was used as early as 1916 to furnish weather forecasts to those equipped and trained to receive the transmissions. It naturally followed that attempts would be made to utilize the radio telephone for similar purposes as soon as it was perfected. According to a University Press Bulletin, the first regular scheduled telephone broadcast was in March, 1920, several months before stations considered to be the broadcast pioneers went on the air.

Prof. E. M. Terry

During the summer of 1920 Professor Terry and his associates constructed a new transmitter of 500 watts power and placed it in operation that fall. The call 9XM was retained, and wavelengths of 475 and 800 meters were used. Early in 1921 a regular weather forecast schedule was established, and the Department of Agriculture and Markets furnished market quotations. The extension division recognized the possibilities of broadcasting and entered the field of program production. With concerts, sports broadcasts, and faculty talks following later that year the art of broadcasting rapidly developed. The broadcast call of WHA was assigned January 13, 1922, and the station's frequency specified as 618 and 833 kilocycles.

It is of interest to compare the activities of the University of Wisconsin experimenters with those of the Pittsburgh group. It was during Sepember, 1920, that the officials of the Westinghouse Electric and Manufacturing Company realized the commercial possibilities of radio through the stimulation of demand for radio sets. One of their engineers, Dr. Frank Conrad, had been experimenting with radio telephony, and with his assistance the company constructed an experimental station 8ZZ. It was this station that reported the Harding-Cox election returns on November 2, 1920. Later, 8ZZ became the first licensed broadcast station when it was given the call KDKA. Although 9XM did not become WHA until after KDKA was licensed, the early broadcast activities of 9XM positively pre-date those of 8ZZ.

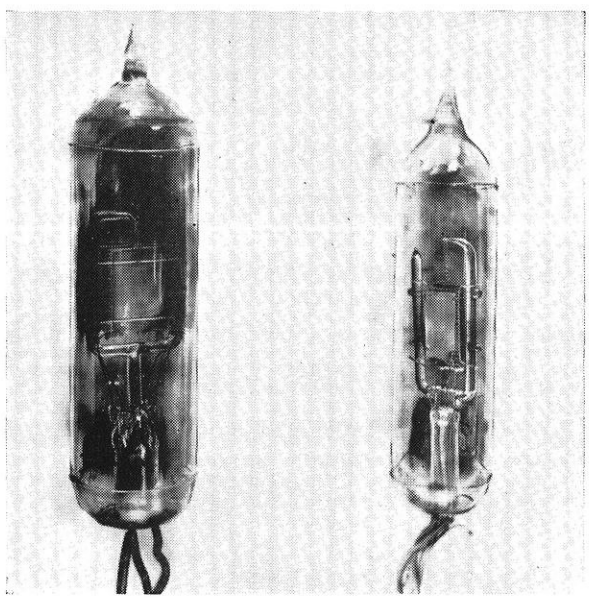
Filed licenses show that WHA was assigned successively to the following frequencies: 833, 660, 230 to 235 (special), 560, 940, 900, 570, and 940 kilocycles. In the reallocation of broadcast stations by the Federal Radio Commission in 1928, WHA was placed on 940 kilocycles, permitted daytime operation only, and allowed a power of 750 watts. Except for various power increases the station has operated on this basis to the present time.

The station was under the supervision of the Physics Department up to the time of the death of Professor Terry in May, 1929. Technical control of the station then passed to Prof. Edward Bennett, chairman of the Electrical Engineering Department.

In addition to WHA at the University, another state-owned station developed under the Department of Agriculture and Markets. To furnish market quotation service to the northern part of the state, this department in 1922 constructed WPAH at Waupaca. Two years later the station was moved to Stevens Point, where it has since been operated as WLBL.

An attempt was made in 1930 to improve the state's radio facilities by combining its stations, WHA and WLBL. An application was filed with the Federal Radio Commission to replace the 750 watt WHA on 940 kilocycles and the 2000 watt WLBL an 900 kilocycles, both operating with daylight privileges only, with a single full time 5000 watt station at some new location. After this application was denied in June, 1931, the state began a program of developing both stations. At Stevens Point a transmitter site outside the city was secured and a new 2500 watt transmitter put in operation. At Madison the University secured the transmitter site and towers that had formerly been used by station WISJ. The WHA transmitter was moved from Sterling Hall to its new location in July, 1932.

A 1000 watt transmitter was put in operation in November, 1932, and in September, 1934, stepped up to 2500 watts. In September, 1936, a 5000 watt transmitter was installed. These various transmitters of WHA were constructed at the University by the station's operator staff and the mechanicians of the College of Engineering under the direction of Prof. Glenn Koehler.



The Early Experimenters Constructed Their Own Tubes

An exchange of programs between WHA and WLBL was begun in January, 1933, when a leased wire was obtained between the two stations. In curtailment of state expenses this line was discontinued in October, 1933, and a temporary system of rebroadcasting installed. Using a special receiving antenna system, WLBL picks up the WHA signal and re-transmits it. WHA now originates all of its own programs and WLBL about half of its programs, the remainder being obtained from WHA by rebroadcasting. A substantial portion of the listeners of the state are served by one or both of these state stations. They are both operated non-commercially and have never sold time on the air.

The first telephonic broadcasts of the University station were put on in a small padded booth, adjacent to the transmitter in the basement of Sterling Hall. Later a room on the first floor was obtained which remained the sole studio-control room until late in 1934. The necessary control apparatus was placed in one corner of this room, all program monitoring being done with headphones by the studio operator. This and other handicaps, such as the lack of adequate office space, made program production extremely difficult. Since room for expansion was not at hand, a new home for the station was sought.

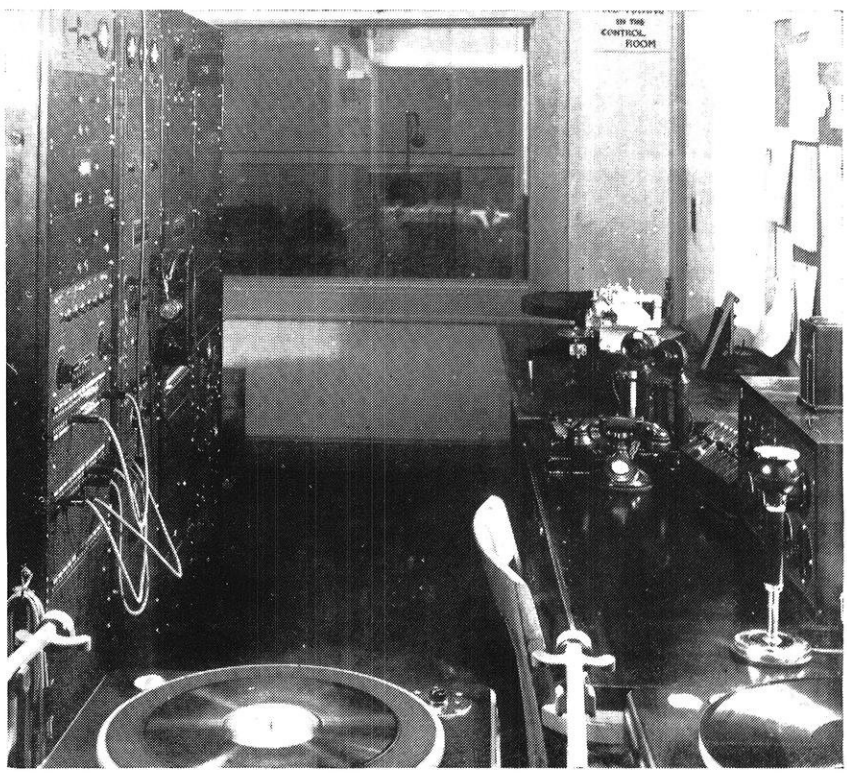
In the fall of 1933 it was decided to remodel the old mining laboratory into new studios and offices for WHA. This building, located on the campus just behind Science Hall, remained unoccupied when the mining department moved to the building vacated by the Forest Products Laboratory. The building is one of the campus landmarks, since it was constructed in 1882 and used as the University heating plant until about 1908. Since its transformation into a radio center, it has been known as Radio Hall.

The broadcasting layout developed at Radio Hall has proved to be a very workable one. Perhaps the most severe limitation in the remodelling was the location of the steel girders peculiar to this type of building. It was possible, however, to group three studios about a centrally located control room, allow for four offices, and a reception room. Adequate sound-proofing was obtained by double wall construction. Broadcasts can originate in any studio or combination of studios and the proceedings watched from the reception room observation windows. Rehearsals and broadcasts can be carried on simultaneously. Since the entire building was not utilized, space is available for future expansion. At present, a project is under way to provide additional office space, work rooms, and another studio with its control room.

One of the largest pipe organs in the country used solely for radio is installed in Radio Hall. It was formerly used by a Madison theater and was obtained for a fraction of its original cost.

Record making has become an important part of the work carried on at WHA. Records of quality satisfactory for broadcast purposes can be made. This permits greater versatility in broadcast production; for instance, a group of students which ordinarily could not assemble for a daytime broadcast can meet at a convenient time and record one or several programs. Some of these records are furnished to other stations in Wisconsin for broadcasting. Records are also extensively used in the criticism and analysis of programs.

Broadcasting from many other points on the campus is made possible by an extensive system of remote lines installed to Music Hall, Bascom Hall, Memorial Union, Agricultural Hall, the Field House, the Stadium, and the Stock Pavilion. When it is desirable to broadcast from some other point, temporary extensions to these lines are made. By means of a leased line to the State Capitol, important legislative events and messages from the Governor and other state officials are broadcast.



Main Control Room in Radio Hall

From the early days of radio telephone experiments, broadcasting at the University of Wisconsin has steadily developed to the present day WHA. Many persons have contributed much to make possible this progress in the development of a new branch of science and in its application to the service of the people of the state.

(Acknowledgement is given to K. M. Gapen, Washington, D. C., and to H. A. Engel, WHA, for their assistance in furnishing much of the historical material in this article.)

(EDITORS' NOTE—An article describing the WHA 5000 watt transmitter that has just been installed will be forthcoming.)

A Homely Homily . . .

A Sequel to "A Senior Sermon"

by **LEO S. NIKORA, m'36**

• *Herein we present a message from last year's editor of the* WISCONSIN ENGINEER *whose editorial "A Senior Sermon," appearing in the May, 1936, issue of this magazine won first place in national competition as the best editorial published in an engineering college magazine this past year.*

WELL, here you are now. Studying engineering. As a Freshman, just how did you come to choose engineering? Or, as a Sophomore, what makes you continue in the Engineering College? Mayhap you are a Junior—are you still, heart and mind, set on being an engineer? Or, lastly, you may be a Senior; are you satisfied? . . . or are you suffering?

For the first time in my life, I find myself far enough along to get a good panoramic view of this whole business (even though, I grant you, it is still slightly distorted by the unfinished lens of a youthful eye). Yet, I've not been out of school so long that the vividness of your experiences is lost to me.

So, now that you are ready to rear back and ask, "Who do you think **you** are?," I am equally ready to admit—"Nobody." But I would like to discuss with you some things I wish had been brought to my mind when I was at your station in life.

First of all, let's consider your most vital interest in life (forgetting, if possible for a moment, the girl friend). Are you really all wrapped up in engineering? For the next fifty years, would you like to eat engineering, sleep engineering, talk engineering, study engineering, see engineering?

When you decide upon the "lucky woman," you will settle in your mind whether you could, without ever becoming overly annoyed, spend the rest of your life with her. You will make certain that those little habits she has . . . . of saying "ain't," of clicking her tongue, of smoking—that all those are as nothing—that any other girl is "as a candle to the sun." With a similar attitude of mind, would you take engineering "to wife"?

College is the place to decide where your interest lies. Across the hall is a fellow "batty about bugs." He begs you to come into his room, to look under the glass, to see the new specimen he "landed" along the lake road. If he did not consider it sacrilege, he'd even eat the darn things. And in the room next door is a "medic." For hours, while smoke streams from his pipe, he babbles on about operations, injuries, treatments, diseases, how your body functions. Does it intrigue you, too? And then there's the fellow who runs you round the enchanting labyrinth of logic—another dreams of drama all day long—and another can rattle off four or five languages with ease and alacrity. Would such things tempt you to forsake engineering?

Interest. **Your** interest! Something to seriously think about. Neither your father nor mother can decide it for you. Your best friend is little help. No one can tell you what is best for you to do. Advice you will get—oh, yes—in carload lots. But, all to no avail. If you end up doing the thing you hate, if you have to waste a whole life doing that, you were better left unborn.

So, while you are in the university, look around. Join clubs. Get into many activites. Meet people. **Try to get a good glimpse of every side of life!** Don't miss anything. Else, some day, too late, you'll find something superseding engineering—something which will have for you an all-consuming interest—something which will make you hate yourself for not having looked before you leaped.

More than once, lately, college freshmen have asked me what I thought was THE thing for a young man to study in the engineering field; what has the finest opportunities for him; what pays best. To give a "correct" answer to that is more than I would dare to pretend. However, in the light of my very limited experience, I have made some honest efforts to design some sort of reply.

First of all, the thing of which you, as an engineering student, should be most aware, that of which you should be most appreciative, that which you should keep ever before you is—

That an engineering course
Does NOT teach you chemistry,
Does NOT show you how to do problems in calculus,
Does NOT prove the vector sums of forces,
Does NOT inform you of the great advances of science!

BUT AN ENGINEERING COURSE DOES TEACH YOU HOW TO THINK! That is its greatest value!

Any company that hires you, takes you because of that faculty which has been developed in you. You are paying, now, hard earned money to learn to think—industry will repay you many fold, later.

Now then, my conception of an ideal engineering training is a course in Mechanical Engineering, plentifully interspersed with subjects such as Economics, Money and Banking, Commerce, Business Administration, Personnel Management, Speech, Advertising, and Psychology. This particular slant I got through observations and interviews with men from many companies and corporations. You will note—I said **engineering training.** Because (and this brings me to one of my favorite sallies) it is distinct from an ideal **engineering education.** An ideal engineering education, I say, includes all the attributes and functions of an engineering training, as above defined, plus the essences of cultural things such as Music, Art, and Literature. Engineering gains you an existence; Culture, a living.

Many men in the field will tell you that air conditioning is a vocation that offers great possibilities. It is, perhaps, the fastest growing phase of engineering today.

With the above two paragraphs, I did not intend for you to dash wildly into commercial engineering. Nor into the air conditioning field. By no means. Nor did I imply that all other phases of engineering are approaching obsolescence or are "devoid of dough." The advance of the automobile, the building of Boulder Dam, Bay Bridge, streamlined trains—these should be sufficient to convince you that every branch of engineering is dynamic, challenging, and packed with potential profits and interest. But I did mean that trainings such as I have mentioned seemed to me some of the very best, as far as money and opportunity are concerned. Indeed, though, there are other excellent engineering interests—sales engineering, for example. It generally lays claim to being the highest paid division of the profession. To be successfully competitive and profitable, almost every large organization today must have a sales department. Small concerns can do, and most of them are, without a well defined research staff—but they must have a sales division. (Which leads me to interject that, if you intend to become a research man—a position which admittedly does not often bring considerable financial return, yet demands much time and effort—a whole flock of university degrees is highly desirable. However, if you prefer to enter into the production, sales, or some other such side of the profession, you would do well to limit yourself to a bachelor's degree. Companies commonly complain that a man with an advanced education is hard to mold, is too observant of trivialities and technicalities—he will "walk rather than think in straight lines." Unless you are going into research, an advanced degree, then, would be an uneconomical investment—it would consume precious time and money.)

Upon being out of school a while, I found that, contrary to popular opinion in college, industry is **not** crowded with university graduates. But it is crowded with a lot of people who wish they did have degrees. Industry is hiring college men for executive positions. And that is what you should be most prepared for. It seems that industry is in a state such that it recognizes the worth of your training, because it has had just enough contact with university graduates to want more of them. More than that, **your promotion in most companies will depend on the fact that you act and think in the characteristic manner of a college man**—a manner which, these concerns feel, must accompany the experience and natural brilliance of a man in the executive station!

There is, to this thing, another aspect not to be neglected. Money. As an airplane pilot, you would make a great deal of money. But the health requirements are so rigid that your **time** of earning would be quite short. Or, you might select a career in the moving picture realm—where fame is flighty, and money-making uncertain. Possibilities such as those, you must consider against a kind of work which would give you a rather quiet, unhurried, and fairly secure life. You see, it all resolves itself into whether you want to run considerable risk, and make much money in a short time; or, whether you would prefer working slowly and steadily to a moderate income. In other words, think of your time of earning power, not just for the amount.

Make this, then, your day of reckoning. If you are not happy in your present work, if even the future looks mighty grim, and if several unsuccessful years in the engineering course lie behind you, don't hang on simply because you will not admit defeat. You're not ashamed if you have no ear for music or no eye for color. And no honest effort followed by failure should cause you embarrassment. Through the trails of trial and error, you come to your "final set." If people chide you for changing your mind about what you want to do for a living, just bear in mind that **you are leading your life.** Your life is yours—and if you don't do something about it, very few others will—**some people never even get a proper burial!**

On the other hand, think twice before you decide to set aside engineering for some other profession. An "engineered" brain functions beautifully even in its ordinary thought processes.

Engineering inoculates you with a good deal of "common sense."

It increases your appreciation for the things you use and live in every day.

It acquaints you with almost every side of life and living.

It requires neither an "internship" nor a "shingle."

It is creative, yet conservative.

It gives you and others an opportunity to actually see and feel the results of your labors—results which are intimately and immediately bound with the good and progress of mankind.

And, finally, engineering is the miraculous link between society and science.

Rural Electrification in Wisconsin

by **V. M. MURRAY, m. s. '34**

Assistant Chief Engineer,
Wisconsin Rural Electric Cooperative Association

•

THE Rural Electrification Administration was established in May, 1935, under the provisions of the Emergency Relief Appropriation Act for the purpose of financing the building of distribution lines, and, if necessary, transmission lines and generating stations, to supply electrical energy to the rural districts of the United States. Money for this purpose was loaned originally under the Relief Appropriation Act mentioned above, but since July 1, 1936, is now available under the Rural Electrification Act (The Norris-Rayburn Bill). This Act provides for a ten year program. The money is loaned at not over 3 per cent to utilities or cooperatives. To date the cooperative method has proven the more effective in Wisconsin as these organizations—banded together for the sole purpose of supplying energy to their farmer members—build on a project basis. By thus building, 100 to 500 miles at one time, these cooperatives are able to reduce construction costs to such a low figure that all consumers in their territories can be served.

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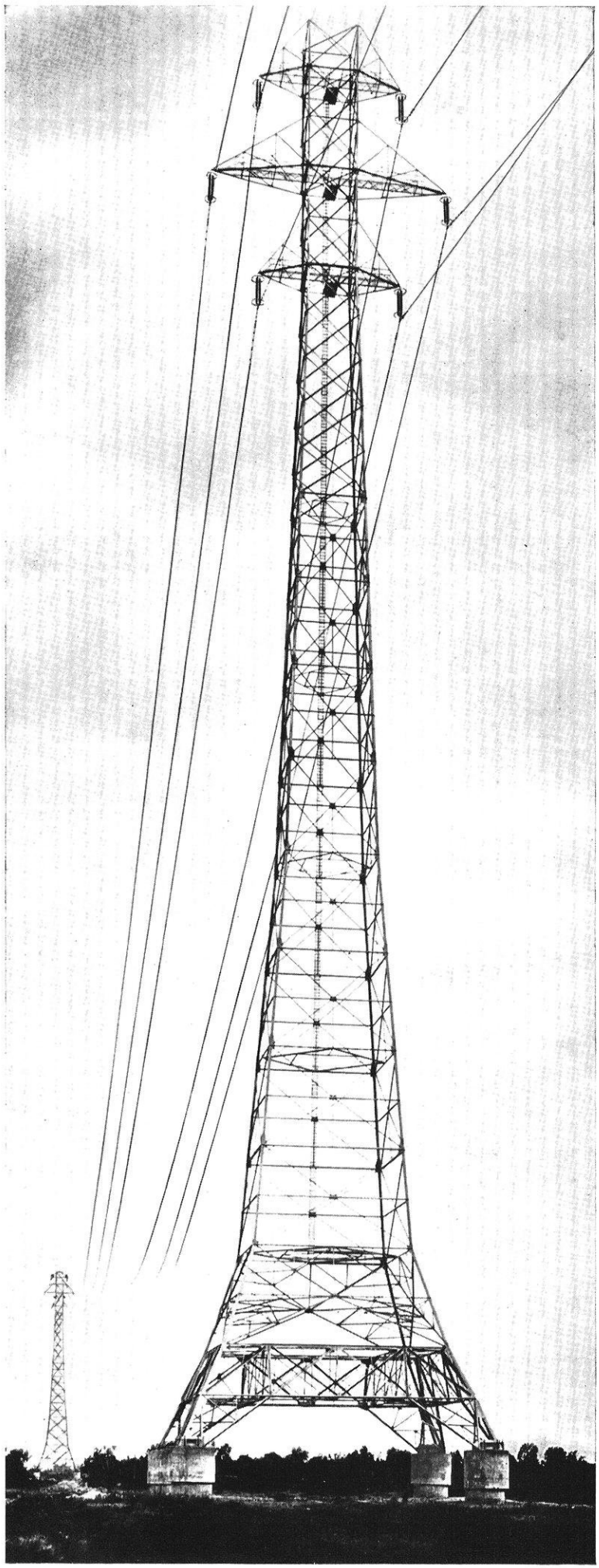


• *Because it reduces cost, the REA is constructing rural lines with fairly short poles and long spans. They have found that copper wire is too expensive for this work and are using steel-core aluminum wire or the product "Copperweld" which has a steel core coated with a relatively thin coat of copper.*

• *The illustration shows a long span crossing the Mississippi river. Steel-cored aluminum wire is used.*

• *Picture courtesy* Metal Progress.

Considerable difficulty was at first encountered in Wisconsin in obtaining allotments for Electrical Cooperatives. In order to get an allotment a cooperative had to organize —employ engineers to make a survey—to present to the REA at Washington—to get the allotment and thereby have funds—to pay engineers. In order to overcome this difficulty, Governor La Follette in October, 1935, established the Committee on Rural Electrification Coordination. This "Coordination Office" undertook to inform the farmers on methods of forming an electric cooperative; instruct them in making preliminary surveys; and to send this survey to Washington for an allotment. So successful has this committee been that Wisconsin now ranks first in the United States in allotments granted with a total of $3,454,600.00; and an established annual allotment for the next nine years based on the number of farms yet to be electrified.

Besides fostering the growth of local electric cooperatives, this committee encouraged the formation by the cooperatives of a statewide association. Such an organization was formed in April, 1936, under the name of the Wisconsin Rural Electric Cooperative Association. This organization at present consists of two departments—engineering and legal; and handles all work of such nature for the member cooperatives. At the present writing there are sixteen member cooperatives of this association, and there are under the supervision of this engineering department:

A total of 562 miles of line under construction; 504 miles of line for which bids have been opened and contracts are pending; 823 miles for which all field work is completed and plans and specifications for bidding are being prepared. There are 5,746 members of eight different cooperatives involved in the above mileage figures. In addition to this, the Coordination is now assisting in the development of twenty-five new cooperatives with a perspective membership of 12,018.

Some of the more important features of present REA line construction in Wisconsin are:

All construction must conform to the Wisconsin State Electrical Code except where this code is more lenient than the National Electrical Safety Code,—under which conditions the national code applies.

All contracting firms building these lines must be bonded for an amount equal to 100 per cent of their bids.

Stringing of conductors is to be done under supervision of engineers of the company supplying the conductor.

All lines are staked by engineers of the Wisconsin Rural Electric Cooperative Association, and construction is supervised by a resident engineer from this organization.

The standard type of distribution circuit now being used is 7200/12,500 volts, three phase four wire Wye, with the neutral grounded nine times to the mile.

All conductors used to date (except service drops) are steel reinforced. The design is such that no conductor will be stressed beyond 60 per cent of its ultimate strength under heavy loading conditions of one-half inch of ice, 8 pounds wind (57 miles/hour) at O°F.

All secondaries on the same pole as the primaries must be of the same size and material as the primaries.

The minimum pole size permitted is Class 6, and the smallest conductor is No. 6 A.W.G. copper equivalent.

The standard type of service drop is 120/240 volts 3 wire, single phase.

The minimum transformer size is 1½ kva with at least two 5 per cent full capacity taps. All transformers have individual lightning arresters and fused disconnecting cut-outs.

The 23rd Psalm Of An Engineer's Sweetheart

Verily, I say unto you, marry not an engineer.

For an engineer is a strang being, and is possessed of many evils.

Yea, he speaketh eternally in parables which he calleth formulae.

And he wieldeth a big stick which he calleth a slide-rule,

And he hath only one bible, a handbook.

He thinketh only of stresses and strains, and without end of thermodynamics.

He showeth always a serious aspect, and picketh his seat in a car by the springs therein and not by the damsel.

He does not know a waterfall except by its horsepower, nor a sunset except that he must turn on the light, nor a damsel except by her live weight.

Always he carrieth his books with him, and he entertaineth his sweetheart with steam tables.

Verily, though his sweetheart expecteth chocolates when he calleth

She openeth the package but to disclose samples of iron ore.

And he kisseth her only to test the viscosity of her lips.

For in his eyes there shineth a far away look that is neither

Love nor longing—rather a vain attempt to recall a formula,

There is but one way to his heart, and that is Tau Beta Pi, and

When his damsel writeth of love and signeth with crosses, he

Taketh these symbols not for kisses, but rather for unknown quantities.

Even as a boy he pulleth a girl's hair to test its elasticity.

But as a man he discovereth different devices; For he counteth the vibrations of her heartstrings; And he seeketh ever to pursue his scientific investigations even his own heart flutterings he counteth as a vision of beauty, and enscribeth a formula.

And his marriage is as a simultaneous equation involving two unknowns, and yielding diverse results.

—The Annapolis Log.

ALUMNI NOTES

Electricals

ANDREWS, C. F., '28, is with the Northern Utilities Company of Dixon, Illinois.

BALLINGER, LOWELL, '36, is working in the instrument department, Sinclair Refining Company, East Chicago, Indiana.

BOLDT, ROBERT EDWARD, '36, has been employed by A. O. Smith Corporation, Milwaukee, Wisconsin.

FRITTS, WALTER N., '34, is engaged as a designer with the Electro-Motive Corporation, La Grange, Illinois.

KIECKHEFER, H. H., '33, has resigned his position with the Oil Gear Company of Milwaukee in favor of Barber Coleman Company, Rockford, Illinois.

MEISTER, MELVIN W., '36, is also with A. O. Smith.

MUSIL, LOUIS F., '04, died on October 1 at his home in Scarborough, New York.

NIELSEN, ARTHUR C., '18, president of Nielsen Service Company, recently delivered an address on Continuous Marketing Research before the Annual Convention of National Association of Cost Accountants. The Nielsen Service Company has new location at 2101 Howard Street, Chicago, Illinois.

ZABEL, H. H., '31, was married last month to Sylvia Petersen, B.A. '32. Mr. Zabel has been associated with the laboratories of the Allen Bradley Company, Milwaukee, since his graduation.

>□<

Civils

BENNETT, KEITH H., '36, is learning the intricacies of the cranberry business under his father at Warrens, Wisconsin.

DAHLMAN, JOHN H., '32, is assistant to the chief engineer on WPA projects in a district comprising 13 states. His headquarters are in Chicago.

DEVER, HARRY C., '32, is structural designer with the Sinclair Refining Company at East Chicago, Indiana.

HUBER, WILLIAM G., '20, is working for TVA at Knoxville on the design of the Pickwick Landing power house.

LEMKE, GEORGE A., '36, is an engineer with the city of Superior, Wisconsin.

McCOY, JULIUS M., '25, is superintendent of construction on the new hydraulic laboratory at the University of Minnesota.

MATTHIAS, CARL DOUGLAS, '36, has the position of Inspector, U. S. Army Engineers, Milwaukee, Wisconsin.

POSS, ROBERT V., '30, in the capacity of Junior Engineer, is doing survey and inspection work on piers, breakwater construction, and dredging for the U. S. Army Engineering Department, Milwaukee, Wisconsin.

>□<

Miners and Metallurgists

HULTEN, DONALD, '32, is employed in the standardization department of the Kohler Company at Kohler, Wisconsin.

KIEWEG, BURTON R., min.'32, M.S. '33, is chief engineer at the U. S. Department of Agriculture Forestry Camp, Park Falls, Wisconsin.

LOTTER, JOHN, M.S. '36, is assistant metallurgist with the Harnischfeger Corporation of Milwaukee.

McCAFFERY, PHILIP, M.S.'32, is now contact metallurgist for the Columbia Steel Company, Torrance, California.

SCHWARTZ, E. H., '18, has the position of superintendent of the open hearth department of Wisconsin Steel Company, South Chicago, Illinois.

SCOFIELD, LLOYD M., '21, has resigned his position as assistant chief engineer for Pickands Mather Company of Ironwood, Michigan, to assume similar duties with Calumet and Hecla Copper Mining Company, Calumet, Michigan.

WALTERS, E. C., '23, is camp superintendent, U. S. Soil Conservation Service at Viroqua, Wisconsin.

WEGNER, GILBERT, min.'22, M.S. '33, is employed as metallurgist for Columbia Steel Company, Torrance, California.

>□<

Chemicals

BEACH, CHARLES M., '36, is working for the Continental Paper and Bag Company, Marinette, Wisconsin.

BURKE, HARVEY D., '36, is in the physical testing laboratory of the International Nickel Company, Huntington, West Virginia.

GREENIDGE, CHARLES TURNER, '26, is at the Battelle Institute, Columbus, Ohio.

HAMMANN, RALPH A., '35, is employed by the C. F. Burgess Chemical Company of Madison, Wisconsin.

HOFFMAN, ROGER W., '36, has been employed by the Fansteel Metallurgical Company, North Chicago, Illinois.

KORESH, JOSEPH W., '36, has a position with the Ladish Drop Forge Company, Milwaukee, Wisconsin.

KUHE, DAVID B., '24, is now with Continental Paper and Bag Company, Marinette, Wisconsin.

PEPLINSKI, NORBERT J., '36, is with the Sinclair Refining Company, East Chicago, Indiana.

RASMUSSEN, ERVIN W., '31, is working for the Continental Paper and Bag Company, Marinette, Wisconsin.

SCHIEL, MERRILL A., '27, is with A. O. Smith Corporation, Milwaukee, Wisconsin.

SCHINK, NORBERT, '35, formerly with the Chromium Corporation of Chicago, is now in the General Electric X-ray Corporation, training for export trade.

WALTERS, RAY H., '33, is now with the Postum Company, Battle Creek, Michigan.

>□<

Mechanicals

BOSSART, OTTO A., '29, is engaged as a sales engineer for the Modine Manufacturing Company, manufacturers of heaters, located at Racine, Wisconsin.

CAHOON, ROGER C., '28, formerly with the Minneapolis Honeywell Regulator Company, is now employed by the Hollup Corporation, manufacturers of welding supplies and equipment, Chicago.

FREYBURGER, EDWIN, '30, holds the position of chief engineer of the State of Illinois in charge of construction work, machinery, and automotive equipment.

GOELTZ, WALTER H., '32, has employment in the research department of the Northwestern Mutual Life Insurance Company, Milwaukee.

GROTH, ALVIN L., '32, formerly connected with the Burgess Battery Company, is now engaged in modernizing the plants of the Carnation Milk Co., Oconomowoc, Wisconsin.

HAASE, HENRY M., '32, is chief designer of the four-cycle Diesel engineering department of Fairbanks Morse Company, Beloit, Wisconsin.

HUBER, MILON G., '32, formerly an instructor in agricultural engineering at the University of Wisconsin, is now at the University of Maine.

JONES, GORDON H., '31, has a position with the H. D. Hudson Manufacturing Company, manufacturers of farm equipment, at Oshkosh, Wisconsin.

Thank the G-men and the T-men, too.

BEHIND the scenes, in many a capture by G-men, will be found the service provided by T-men—telephone men (and women, too) of the Bell System. ¶ Law enforcement officers make frequent use of both local and long distance telephone service. They depend on the Teletypewriter, for quick and accurate transmission of written messages. They tighten their nets with the aid of yet another Bell System development, police car radio. ¶ And so the telephone, with products and services growing out of it, helps to make your life happier, broader and more secure.

Why not report "All's well" to the folks at home? For lowest rates to most points, call by number after 7 P. M. any day or anytime Sundays.

BELL TELEPHONE SYSTEM

ON THE CAMPUS

CIVILS SKID IN VOCABULARY

The junior civils have just gone through a vocabulary test in the course in "seminar" and have produced some new-deal definitions of well-known engineering words. It is obvious in every case that the definer had another word in mind when he wrote his definition.

Laminate—mourning
Lucrative—laughable
Inimical—original
Incipient—silly
Septic—doubtful
Ramp—to scamper
Ceramic—blue

OUTSTANDING SOPHOMORES HONORED

At the lecture for freshman engineers held at 11 o'clock on Friday morning, October 16, 1936, in the auditorium of the Chemistry building, the following awards were made.

Tau Beta Pi, the honorary engineering fraternity, presented its annual award of a slide rule to A. Allan Jankus, c'39, who made 99 out of a possible 102 grade points during his freshman year, leading his class in scholarship. The presentation was made by Gerard A. Rohlich, c'37, president of Tau Beta Pi.

A handbook for chemical engineers was presented to Leo A. Fuchs, ch'39, who was the highest ranking freshman chemical engineer of last year and second highest in the entire freshman engineering class. This award was given by the Student Branch of the American Institute of Chemical Engineers, and was presented by Ralph Goetz, ch'38.

A civil engineering handbook was presented to John J. Huppler, c'39, by Chi Epsilon, the honorary civil engineering fraternity. John made the second highest record last year of all those taking the freshman civil engineering course. The presentation was made by Howard R. Jensen, c'37, president of Chi Epsilon.

Eta Kappa Nu, honorary electrical fraternity, recognized their highest ranking freshman electrical engineer of last year, Conrad Hoeppner, e'39, by presenting him with a subscription to "The Electrical Journal" for two years. Herbert Luoma, e'37, made the presentation.

EXTENSION CLASS IN E.E. ESTABLISHED AT APPLETON

Prof. L. C. Larson of the electrical engineering staff is conducting an extension class in E.E. on Friday evenings in Appleton.

ENGINEERING FACULTY ACTIVE IN RURAL ELECTRIFICATION SHORT COURSE

The fourth annual Rural Electrification Short Course was held here October 22, 23, and 24 with many of the engineering faculty on its instructional staff. The Rural Electrification Short Course was held for the purpose of providing a leader-training school in the use of electricity on the farm. The subjects presented were those which would best aid the estimated 10 to 15 per cent of Wisconsin farm families who will receive electricity for the first time in the next 12 months.

The subjects presented by the members of the engineering staff were as follows: "Getting Acquainted With Electricity," by Prof. C. M. Jansky, extension division; "How to Tell Quality in Home Appliances," by Prof. R. E. Johnson, director of the Electrical Standards laboratory; "Lighting on the Farm," by Prof. Johnson; wiring demonstration, by Prof. L. C. Larson, of the E.E. department; "Economics of Electricity on the Farm," by Prof. Edward Bennett, of the E.E. department; "Electricity and Insulation Help Solve the Heating Problem," by Prof. G. L. Larson, of the M.E. department; and a practice laboratory in wiring conducted by L. E. Kelso of the E.E. department.

PROF. JOHNSON PUBLISHES ARTICLE IN ELECTRIC REFRIGERATION NEWS

Prof. R. E. Johnson of the electrical engineering department wrote an article for the Electric Refrigeration News which was published March 25, 1936. This article was based on the feature regarding ice box tests published in the February, 1936, issue of the **Engineer.** The editors of the Electric Refrigeration News saw the report published in the **Engineer** and wrote Prof. Johnson asking for a more complete report for their paper. The ice box tests were conducted by Prof. Johnson for Consumer's Research and were some of the most extensive tests of their kind which have been made in recent years.

SONS OF ALUMNI FOLLOW FATHERS' FOOTSTEPS

Enrolled as freshman engineers this year are a goodly number of sons of alumni of the University of Wisconsin, College of Engineering. They are:

Student	Father
Henry Allen	Andrews Allen, c'91
Walter A. Blair	W. F. Blair, m'15
Robert N. Braun	Alvin C. Braun, ch'20
Geo. H. Crowell	Geo. G. Crowell, e'10
W. J. Fahlberg	E. D. Fahlberg, ch'18
L. William Fleck	Louis C. Fleck, ch.c.'17
Charless Hahn	Emanuel Hahn '17
Kenneth E. Higley	H. V. Higley, ch'15
William P. Harlow	John A. Harlow
Paul D. Mitchell	P. D. Mitchell, c'16
Thos. J. Morrissey	P. W. Morrissey, m'05
D. C. Osterheld	C. M. Osterheld, e'14
Wm. H. Pulver	Harry E. Pulver, c'11

SOPHOMORES HAVE IMPRESSIVE SCHOLASTIC STANDING

That each class which enters the College of Engineering is more intelligent than the last is evidenced by the fact that during their freshman year one-fifth of the class of '39 were working at the honor or high honor rate. This is a larger proportion than any other class in the history of the school.

Records follow:

HIGH HONOR RATE

	Cr.	G.P. Ave.
Hagg, Arthur C. (2nd semester only)	16	2.94
Jankus, A. Allan	34	2.91
Fuchs, Leo J.	36	2.89
Sanford, Herbert B.	34	2.85
Peterson, Floyd W. (2nd semester only at U.W.)	19	2.84
Hoeppner, Conrad	34	2.82
Dodge, Fred W. (2nd semester only)	15	2.80
Ring, Robert C.	34	2.78

HONOR RATE

Huppler, John J.	34	2.73
Parent, Robert J.	36	2.72
Bondehagen, Melvin	32	2.69
Brodzeller, Leo E.	34	2.68
Rezba, John S.	36	2.67
Schuette, Roger E.	36	2.67
Wright, Hugh W.	34	2.65
Thompson, Glen A.	36	2.64
Hamachek, Richard L.	33	2.60
Weseloh, John W.	36	2.61
Bartolowits, Fred F.	34	2.59
Amery, George R.	28	2.57
Bauer, Edward E.	34	2.56
Christianson, Thos. K.	34	2.56
Forsgren, Karl E.	34	2.56
Kutchera, Harvey W.	34	2.56
Hood, William E.	36	2.53
Johannes, Kenneth P.	34	2.53
Kommers, William J.	34	2.53
Metter, Richard W.	34	2.53
Heuser, John E.	35	2.52
Brittan, Raymond O.	36	2.50
Ludvigsen, Carl W.	36	2.50
Plumb, Mahlon J.	34	2.50
Wadell, Stanley F.	36	2.50
Webb, Robert G.	36	2.50
Albrecht, Edmund H.	29	2.48
Thorkelson, Wm. L.	36	2.47
Voss, Arnold W.	34	2.44
Browne, Philip L.	30	2.43
Perko, Albert R.	36	2.42
Anderson, Mary A.	30	2.40
Hartwig, Karl T.	34	2.38
Koehler, John W.	36	2.39
Neipert, Marshall P.	34	2.35
Eron, Allan H.	36	2.33
Dietrich, Harold A.	34	2.32
Eickner, Herbert W.	34	2.32
Newman, Robert J.	34	2.32
O'Leary, James G.	30	2.30
Schubert, Raymond P.	36	2.30
Crosland, Howard C. (2nd semester only)	17	2.29
Vander Wall, Clifford C.	34	2.26
Blodgett, Don G.	36	2.25

SCHOOL FOR STATE INSTITUTION OF POWER PLANT ENGINEERS HELD HERE DURING JULY

Last July 29 and 30 the School for State Institution of Power Plant Engineers was held here under the direction of John C. White, honorary M.E. and state superintendent of power plants. Profs. L. C. Larson, G. C. Wilson, D. W. Nelson, and R. E. Johnson assisted in the instruction. Pat Hyland was the toastmaster at the dinner given the first evening.

ENGINEERS FIND TIME FOR FOOTBALL

How they do it we don't know, but there actually are two engineers, a senior and a junior, on the Wisconsin football squad. The junior is Ralph Kutchera, who has found time when not practicing football to study civil engineering. Then, we have Ed Christianson, senior mining engineer, who is doing his bit to help the Wisconsin cause along.

WITH THE SOCIETIES

A. S. C. E.

Wednesday, October 14, the civils held their first meeting of the year. It lasted only long enough for the group to elect Spaulding Norris '37 its secretary to fill the place left vacant by the death of Jack Lechner '38 last summer and to approve the activity outline presented by Theodore Hoffman '37, their program chairman.

Thursday, November 5, the Civils and Mechanicals held a joint meeting in the Engineering building auditorium. Mr. Colbert gave another short talk on writing papers for the Charles T. Main award, the winner of which receives a $150 prize. The general subject of these papers this year is to be the influence of machines on the trend of labor problems. Mr. Colbert will consult with anyone who is interested in further particulars.

The main speaker of the evening was Mr. Simond from the Four Wheel Drive Company of Clintonville. He showed films demonstrating the abilities and uses of the trucks his company manufactures and at the close of his talk gave out several pamphlets which described the building of trucks in much more technical detail than he had.

The next meeting of the A. S. C. E. will be held during the week of November 16.

CHI EPSILON

Chi Epsilon, civil honorary society, announces the election of officers for the year '36-'37. Howard Jensen, Edwin Voss, Wayne Johnson, John Eppler, and Arthur Luecker were respectively installed as president, vice-president, secretary, treasurer, and associate editor of the Transit.

Olaf Laurgaard, c'03, has been elected as chapter honorary member. Mr. Laurgaard, who is at present general office engineer of TVA, was formerly city engineer of Portland, Oregon, and construction engineer on Parker Dam. Mr. Laurgaard is one of Wisconsin's outstanding engineers.

PI TAU SIGMA

Pi Tau Sigma, honorary mechanical engineering fraternity, held its intiation ceremonies and banquet the evening of Wednesday, November 4. Mr. O. C. Cromer acted as toastmaster. As the main speaker of the evening, Mr. Arthur Koehler, our Forest Products Laboratory expert on woods, presented a talk on his part in the Lindbergh case.

The senior initiates were S. M. Austin and F. O. Ibisch. The juniors were W. G. Hanson, S. J. Kranc, R. N. Sabee, and R. U. Stanley.

A. S. M. E.

MINING CLUB

At the Mining Club banquet held Monday, November 9, in the Mining and Metallurgical building, Dr. George Otis Smith, past director of the United States Geological Survey and past president of the A. I. M. E., described the latest developments in the A. I. M. E. and urged the students to join the institute so as to utilize its benefits and contacts.

About seventy persons, including miners, metallurgists, and geologists, were present at the dinner which was prepared by the mining students under the direction of John Yarnutowski.

Analagous to the concurrent situation in the university athletic department, was the shake-up in the Mining Club's athletic organization with a resultant "New Deal" for sports and the appointment of Eugene Mullin as athletic director. The immediate cause was the ignominious defeat suffered at the hands of the geologists a few weeks previous.

A. I. Ch. E.

The A. I. Ch. E. nominates Gilbert Olson, president and champion of the Liars Club. He was the man that fooled Professor Mathews and his lie detector. One of the others, with no hesitation at all, indicated to the machine that his sweetheart's name was Lois, but Gilbert held out. Wednesday, November 4, Professor Mathews gave a talk on his experience on the "Lie Detector and the Use of Drugs in Detecting Crime" in the Old Madison room at the Union. The meeting was exceptionally well attended, thus testifying to the worth of the efforts of the program committee and their new idea of giving members notification of the meetings by mail.

After his formal talk and experiments were over, Professor Mathews held an informal conference around the machine, explaining more technically its operation and uses. As a close to the evening, pretzels and beer were served and several selections were played on the piano.

A. I. E. E.

A. I. E. E. had its first meeting of the semester early in October at the University Club. The officers tried to interest the members in joining the national organization and August Ferber was chosen junior Polygon representative.

The speaker of the evening was Mr. V. M. Murray, of the engineering department of the Wisconsin Rural Electrification Cooperative Association. He gave an interesting talk on the new standards which have had to be set up since the REA began constructing long units of rural high lines. After speaking, he was kept busy for some time answering questions on this work.

The evening was concluded with cider and doughnuts.

"STATIC"

By **ENGIN EARS**

He's here, he's there, he's everywhere! Who? Why, the Voice of Experience:

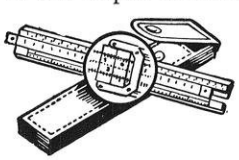
ADVICE FO' FROSH

or

The Care and Feeding of the Slide Rule

The slide rule, they say, was St. Pat's gift to math-crazy Engineers. To those frosh still awed by the sight of a trig-trombone let us say that there comes a time in every man's life when he needs one; this is it. Besides its purely business utility, the guess-pole is the parent of the most blessed of alibis, of the excuse perfect, which is known in the profession as "slide rule error"!

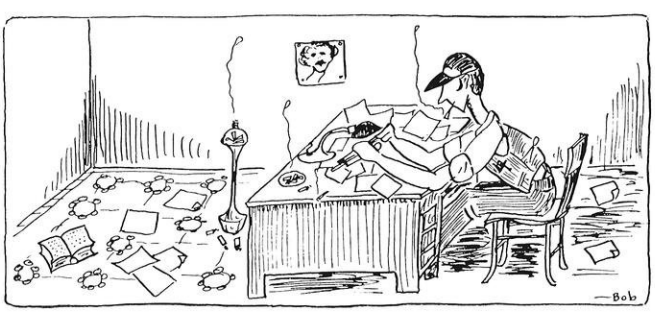
There are rules and rules—from the modest Mannheim to the super Deci-trig. The initial cost of one's rule is



directly proportional to the root-mean-square of the buyer's bank balance. Purchase is but the first step; tinkering and gadget adding naturally follow. There are literally dozens of prisms and magnifiers to choose from—if one **must** read to eight decimal places! On the matter of correct slider friction there are also several schools of thought. Some keep their sliders so tight that making a setting is a series of leaps and bounds from one sticking point to another. By the law of averages, the slider is bound to stick at the right value sometime. Their arch-enemies are the boys whose sliders glide effortless from point to point but also, upon the slightest provocation, skid out and clatter to the floor.

Much individual research has also been done on slider lubrication. We even heard of one unfortunate soph who, in a spirit of scientific curiosity, smeared his runner edges with engine oil! A dash of talcum, we claim, is as good as any—and needn't be changed every 1000 miles.

The new, shiny red case (contrasted with the weathered brown holster of the seasoned slip-stick shark) unfortunately brands its bearer as a novice, but budding engineering ingenuity usually solves even this problem—a little dirt, grease, and boot polish worked thoroughly into the case and a few artistic scrapes on the edges enable the greenest frosh to walk with insolent pride among his elders . . . .



The following are certified by the contributor, one of our better frosh, to be extracts from a scrap-book kept by his parent during university days:

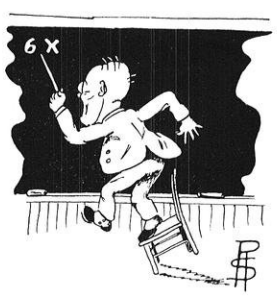
BOARDING HOUSE GEOMETRY

The landlady is a parallelogram; that is, an oblong angular figure which can not be described but which is equal to anything.

Any two meals at a boarding house are together less than one square meal.

The covers on a boarding house bed, stretched however far both ways, will not meet.

If there are two boarders on the same floor and the amount of one side of one be equal to the amount of the same side of the other, and the wrangle between the landlady and one boarder equals the wrangle between the other boarder and the landlady, then shall their weekly bills be equal or, if not, then the bill of one is greater than the bill of the other which is impossible.



The landlady may be reduced to her lowest terms by a series of propositions.

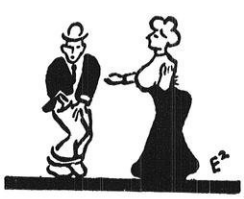
On the same bill, and on the same side of it, there should not be more than two charges for the same thing.

»» ««

Then there was the dumb Ag. student who thought he was majoring in pharmacy . . . .

»» ««

Freshmen and Sophs, don't feel too bad if your Math gives you trouble. Several times this last month Prof. L. A. Wilson has spent half his two-hour period teaching his S. & G. 1 gang how to multiply with simple logs. And about 99% of Mr. Washa's Mech. 3 class were unable to solve a harmless quadratic on a recent quiz . . . .



»» ««

Chem. Instructor: What is an oxide?

Garcia: The outer layer on a male cow.

»» ««

Our prize-of-the-month (a dozen tissue paper pen-points) goes to Robert Merck, M.E. It seems that on a Machine Design quiz last week he designed a cam to rotate clockwise when the question called for counter-clockwise motion. Noticing his mistake a bit too late, the ingenuous Mr. Merck added a note to the instructor at the bottom of the sheet: "Look through back of sheet when marking this problem."

P. S. Merck got full credit on it.

The Locomotive—
Bigger and Better

by **MAURICE C. SWANSON, m'36**

THE day of prosperity is again returning to the railroad. We read and observe almost every day of the increasing railway travel and freight car loadings. New low rates have been introduced; novel, high speed trains have made their appearance. Traffic, both passenger and freight, is going back to the rails.

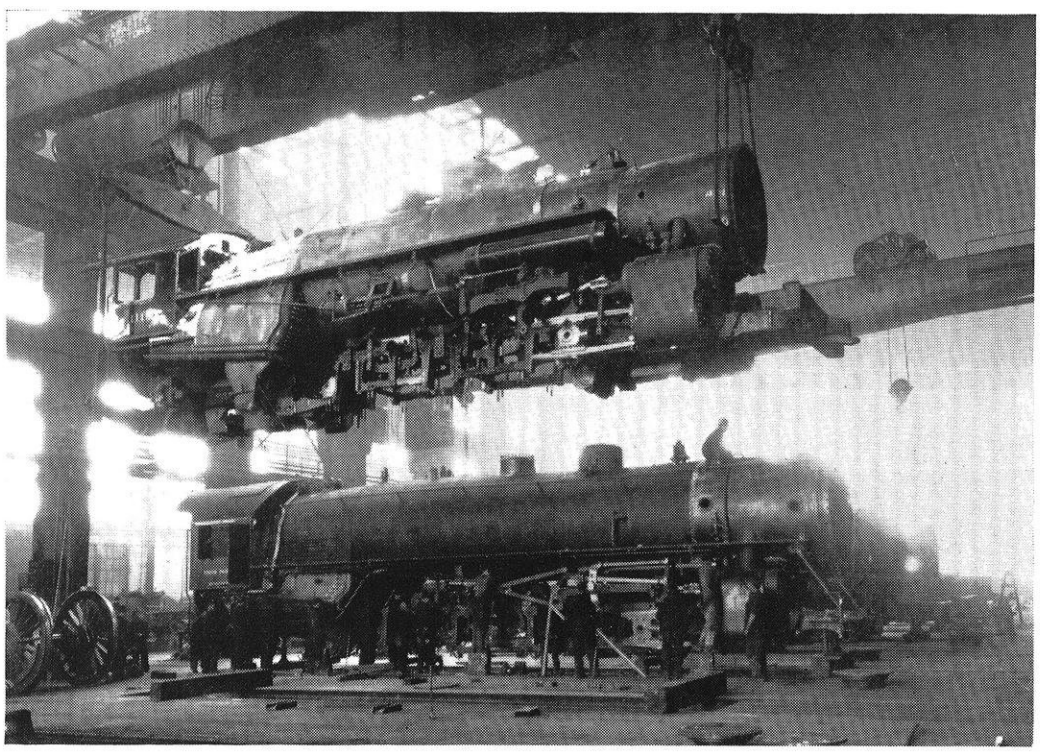
The railroads thus daily feel the increasing need of new motive power, of new locomotives. True, every road has many locomotives, either stored or abandoned for scrap, but the lack of efficient and modern motive power is acute. Thus, as revenues increase and railroad credit and securities improve, many roads will be in the market for new locomotives. These new engines will be larger, heavier, faster, and more efficient than ever before.

In view of this situation, it is not surprising that the three large locomotive companies are again in operation. To make matters even more interesting, a June engineering graduate of Wisconsin has found himself as a special student apprentice in one of them, the American Locomotive Company at Schenectady, New York.

The American Locomotive Company represents the product of a consolidation of smaller companies engaged in locomotive construction throughout the East. Its business, however, is not as specialized as its title might indicate; it is surprisingly diversified and far reaching in its sales and installation.

Following the war, a great consolidation and concentration policy made the enlarged plant at Schenectady the major locomotive works. Here, on a 110-acre site, is located a profusion of buildings consisting of a pattern shop, foundry, hammer shop, some eight or nine machine shops, boiler and tank shops, and an immense erecting floor, research laboratory, paint shops, and a myriad of smaller buildings. The erecting shop resembles a number of massive field-houses placed end to end, with great 150-ton locomotive cranes rolling back and forth against the skylight. It is divided into two sections, with 23 tracks in each, so that a large number of locomotives can be in the process of assembly at one time.

In 1926, the company took over the Railway Steel Spring Company, which produces railway steel springs and tires in a large plant at Latrobe, Pennsylvania. A few years later, the McIntosh-Seymour Corporation of Auburn, New York, makers of diesel engines for marine, stationary, and locomotive service, was acquired. The company now builds the entire locomotive, installing the electric equipment of the General Electric or Westinghouse Company, whichever the purchasing railroad specifies. Previously, the company built diesel-electric locomotives jointly with Ingersoll-Rand of New York and the General Electric Company. Ingersoll-Rand furnished the diesel engines, and General Electric furnished the motors and controls.



The Erecting Floor

In 1928, the Heat Transfer Products Company was absorbed and its operations moved to the old locomotive plant at Dunkirk, New York, which was the ideal place

in which to build heavy oil refinery, heat transfer, fractionating, and distilling equipment. The American Locomotive Company has installed refinery equipment all over the world.

Alco, as the company is called for short, also makes a great variety of miscellaneous equipment ranging from large water pipes and bridge units to locomotive power-reverse gear and boiler stay bolts. Just recently, it acquired the rights to manufacture diesel engines under the Sulzer patents of the great Swiss engine, rail car, and locomotive company—Sulzer Brothers of Wintherthur, Switzerland. Thus, the title is as deceiving as the scope of the business is broad.

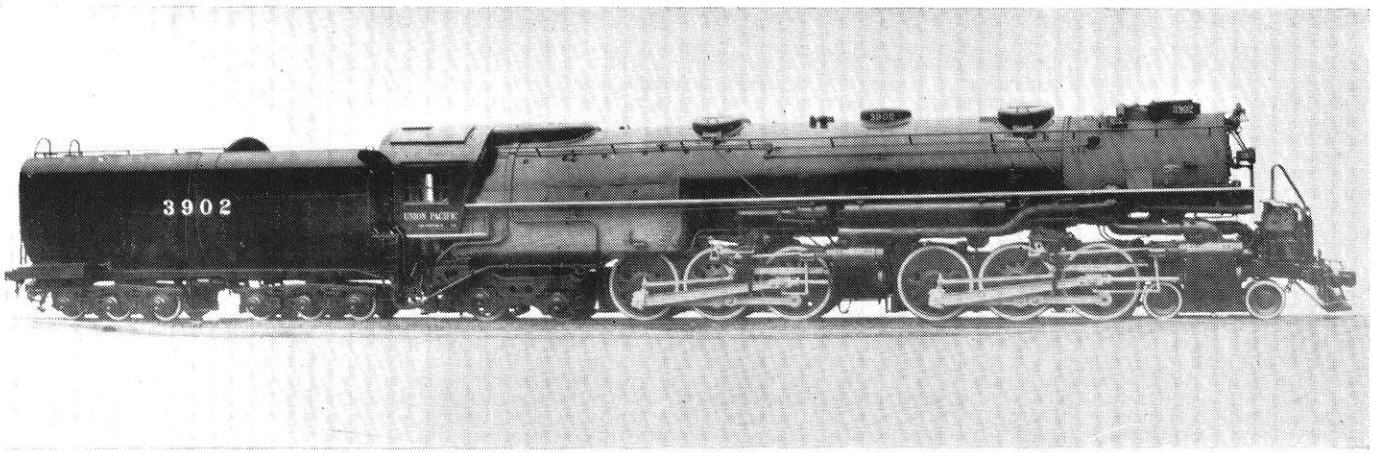
A common impression prevalent even among engineering students is that the only difference between the locomotive of today and that of yesterday lies in its relative size and weight. Yet, like the automobile, the locomotive has had more changes and new features of design incorporated into it in the last five years than in its entire previous history.

Progress has evinced itself most plainly in increased pressure and degree of superheat. The American Locomotive Company has built a four-cylinder locomotive for the Delaware & Hudson Railroad operating with top pressures of 500 lbs. per sq. inch and an experimental locomotive has been built with a closed circuit which operates at pressures as high as 1,500 lbs. per sq. inch, which vies with the highest pressures in modern stationary power-plant boiler practice. It must not be forgotten that it is one problem to build a high pressure boiler for stationary operation and quite another to build one for high speed locomotive operation with absolute limitations of clearance, vibration, and weight, and also complications resulting from the recent high operating speeds of locomotives.

The higher the pressure and degree of superheat, the greater is the energy output or heat drop in the cylinder per pound of water evaporated. Whereas the best locomotive of 1910 developed but 475 h.p. per driving axle and consumed 6½ lbs. of coal per drawbar horsepower, the modern locomotive develops in excess of 1,000 h.p. per driving axle and burns less than three pounds of coal per drawbar horsepower. This consumption compares favorably with that of many stationary power plants.

The exhaust steam feedwater heater is not exactly a new arrival; however, the use of exhaust steam in the injector is a recent development. When the locomotive is standing, thus interrupting the supply of exhaust steam, a large automatic valve admits live steam to operate the injector. The use of an injector in place of a cold water pump introduces the feature of feedwater heating without the use of a feedwater heater, inasmuch as the jet of steam, upon mixing with the incoming water, will heat that water considerably.

In the last years, fireboxes have been built longer and wider thereby diminishing the necessary coal consumption per square foot of grate per hour. The lesser forcing of the fire will result in improved combustion and decreased



New Fast Freight and Passenger Locomotive—Its General Specifications Are Given in the Column Below

energy loss through the smokestack. With the introduction of water tubes to the interior walls of the firebox and new type thermic syphons with greater effective heat absorption surface, it will be possible to absorb more of the high temperature radiant heat from the fire on the grate. Because of the increase in firebox size and resultant large overhanging loads, supporting trailer and booster trucks have become common.

Variation in the type of crosshead guide and support has recently been introduced. The crosshead is suspended from a single bar guide sliding upon an interior multiple bearing surface which is isolated from dust and cinders. This type of guide support can be kept lubricated much more satisfactorily than the multiple-bar guide and is better adapted to the high-pressure lubricating systems, another recent innovation.

The most novel recent development is that of the Loco valve pilot, which is a rather simple mechanism operated through a friction drive from a drive wheel and terminating in an instrument in the cab. The enclosed dial has two pointers, one indicating the position of the cut-off and the other the speed. When the two pointers are superimposed, the locomotive is operating at a cut-off of maximum hauling capacity for that particular speed; when the pointers are not coincidant, their separation is a measure of the economy of the cut-off at that particular speed.

The erecting floor represents the final destination of each of the thousand or more parts of which a locomotive is composed, from the boiler, which might weigh hundreds of tons to a gauge weighing but a fraction of a pound. The boiler comes from the boiler shop; the frame, if assembled, from the heavy machine shop, or, if a solid casting, from the General Steel Castings Plant at Eddystone, Pennsylvania; the wheels come from the wheel shop, and previous to that from the subsidiary tire and spring plant at Latrobe, Pennsylvania; brakes, brake control, and rigging from the New York or Westinghouse Air Brake Companies; the injector might be from Sellers of New York City; the feedwater pump and heater from Worthington of New Jersey; various equipment from Franklin Railway & Supply Company, and a multitude of other things from all over the United States. Thus, to the interested observer, the steam locomotive grows ever more complicated.

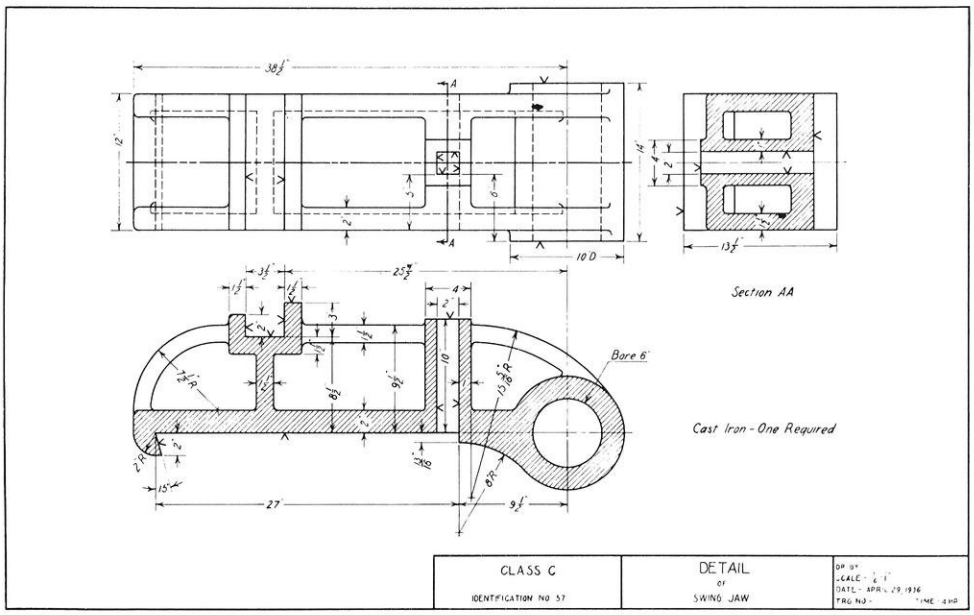
The American Locomotive Company has just recently completed fifteen large fast freight and passenger locomotives for the Union Pacific Railroad, with the following general specifications:

Steam Pressure	255 lbs.
Cylinders	22 in. x 32 in.
Drivers, Diam.	69 in.
Grate Area	108.2 sq. ft.
Heating Surface	5,381.0 sq. ft.
Superheating Surface	1,650.0 sq. ft
Weight on Drivers	386,000 lbs.
Weight, Total Engine	566,000 lbs.
Weight, Engine and Tender	876,000 lbs.
Wheel Base, Engine	59 ft.-11 in.
Wheel Base, Engine and Tender	97 ft.-10½ in.
Tank Capacity	18,350 gals.
Fuel Capacity	22 tons
Maximum Tractive Power	97,400 lbs.

Down at the American Locomotive Works, there has dawned a new day of locomotive design and construction. The new locomotive appears as a brute of great weight, yet capable of very high speeds; tremendous in size, yet built with fineness and precision.

Sophomore Wins In National Drawing Contest

A mechanical drawing by Hugh W. Wright, sophomore mechanical, won second place in class C in the national drawing contest held by the Society for the Promotion of Engineering Education. Only one entry from a school is permitted in each classification and the entries submitted compete with drawings from other engineering colleges all over the country. Two places are given in each classification. Wright was in Mr. F. O. Griffith's class last year. This drawing contest has nine divisions, as follows: freehand pencil drawing, freehand pencil drawing with pencil tracing, freehand pencil drawing with ink tracing, pencil mechanical drawing, pencil mechanical drawing with pencil tracing, pencil mechanical drawing with ink tracing, complete working shop drawing with ink tracing (class C), freehand pictorial sketch, and lettering cards.



The Winning Drawing

The judges in the contest were G. M. Phelps of Rensselaer, chairman, T. T. Aakhus of Nebraska, and A. S. Levens of Minnesota and the announcement was made at a meeting of the Engineering Drawing Division in connection with the 44th annual convention of S. P. E. E. held here in June.

This drawing is the same one that won first place in the third annual **Wisconsin Engineer** Drawing Contest sponsored by Alpha Tau Sigma, national honorary technical journalism fraternity, last May. The **Wisconsin Engineer** contest is held annually some time during the second semester and from its entries the drawing department picks the drawing to be entered in the S. P. E. E. contest.

Wisconsin does not always enter a drawing in the national contest, but has placed **every** time it has entered.

EDITORIALS

WHAT IS TAU BETA PI? Every student who is studying engineering has heard of Tau Beta Pi, but how many know just what it is and what its membership requirements are?

Tau Beta Pi might be looked upon as a reward, or a goal toward which the engineering student strives. It is a national honorary fraternity, composed of engineers, and known as the "Phi Beta Kappa of engineering." Men are eligible for consideration for Tau Beta Pi in the second semester of their junior year or during their senior year. Only active members of Tau Beta Pi select the initiates.

"The true engineer is one who sees visions and follows his visions beyond the beaten path of common practice, and does something that has not been done before, or does it in a better way."

—Bowser

To be considered, juniors must have a scholastic standing in the upper eighth of their class, while seniors must be in the upper quarter. Fulfilling the scholarship provision, however, is not enough to get a man into Tau Beta Pi. He must do something besides school work—show that he has a breadth of interest both inside and outside of engineering. The candidate's character and personality are major considerations. Definitely, the members are elected on a broad basis. Because of this, Tau Beta Pi is the highest honor that can be awarded an engineering student.

It is a high goal to strive for, but one well worth the effort since it recognizes the very best in the education of an engineer.

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"A woman never admits she has lost an argument—she just thinks she has failed to make her position clear."—William Feather

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ON TOP AGAIN Well, fellows, we have a reputation to live up to. The student body has finally been waking up to the fact that the engineers are the one group among them having steady enough nerves and sane enough ideas to keep their bows in the right direction during these days of turbulent strife. Even the lawyers with their reputation as the grossest mass misrepresentators of facts in history can't deny that we have a homecoming chairman and two class presidents this year. Long is the time the engineer goes quietly and unostentatiously about his business expecting and receiving no accolades for his work; but once in every so often he receives his just desserts. However, it's not often, even when the time does come, that he receives such outstanding recognition. This is the year we are in the public eye, boys. Let's keep up the same steadfast work that got us to the top and give Bill Pryor and Jack Heuser the same fine support that we gave Gordon Fuller.

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"The beginning of wisdom is the knowledge of one's faults." —Epicuris

LOOK AHEAD —ENGINEERS A recent speaker aptly put the fundamental difference between engineers and lawyers when he said, "Engineers and lawyers stand together—back to back; the engineers looking forward, and the lawyers looking backward."

That is literally true. Lawyers base their arguments, try their cases, and make their decisions in line with opinions of the past—sometimes going back hundreds of years to dig up an old statute. It is the exception rather than the rule when a judgment is made without precedent. We admit that there isn't very much that can be done to remedy this situation, but nevertheless it is the fact.

On the other hand, engineers are looking to the future —trying to find new ways to aid mankind and improve his standard of living. Look over the great inventions, all were developed in the face of criticisms that "it couldn't be done." We wouldn't have our radios, electric lights, or any of a host of other things if engineers had not gone ahead against public skepticism.

There is one danger though, the great majority of us are too prone to keep on using the old things—"it was good enough for yesterday so it will do for today also." This is the situation we must avoid; it is the attitude that keeps us marking time while using things that have outlived their usefulness. To avoid it, we must encourage experimentation and research.

So, engineers, look to the future. Dare to try new methods or processes. It is the only way we will ever progress.

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The only way to avoid criticism is to say nothing, do nothing, and be nothing.

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It's better to put your shoulder to the wheel than your back to the wall.

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WANT A THOUSAND? Want a thousand dollars, two thousand, fifty, a hundred? All you have to do is use that knowledge that the instructors are trying to pour into you. "We will give one thousand dollars to any person . . . or group . . . which first sends us the formula of a substance which will take tannin out of clothes . . . " This ad is in the entrance to the Chemistry building. Many other similar propositions are waiting in each branch of engineering for those who are interested.

How many of us, on seeing one of these posters, realize that we possess or are getting the knowledge which will enable us to supply the needed information. Get wise to yourself! Capitalize on your opportunities to learn while you can. There are dollars waiting for the ambitious man.

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"True humor issues not in laughter, but in smiles, which lie far deeper."—Carlyle

G-E *Campus News*

ALL-AMERICAN DRILL

The guards on a football team usually take a terrible beating. Coaches often pay tribute to the courage of their guards and marvel at their stamina. Wonder what they would say of one particular hard-headed drill that grinds and plugs away for General Electric in the fractional-horsepower-motor section of the Fort Wayne works. Here's the story:

A couple of years ago, this drill started buzzing around, drilling holes for motors and flanges. It was tipped with Carboloy, a development of General Electric research, and plenty tough. Result—it established a combination speed and durability record by completing 100,247 holes each 1 11/38 inches deep. During the years of its service, it penetrated approximately 2¼ miles of cast iron, at the rate of about 10 inches a minute, before wearing out!

SOMETHING REALLY THIN

Until recently, "by the skin of your teeth" was the very peak of thinness. General Electric, however, now makes a strong bid for a new figure of speech: it is "by a weld's breadth." Engineers at the Schenectady works recently welded together strips of two alloys, Copnic and Chromel, and then rolled them to a thickness of six millionths of an inch.

The material formed by this junction has a very small heat capacity and will respond rapidly to a change in temperature. Engineers estimate that a pound of this product would cost several million dollars.

Gold has been beaten to four millionths of an inch thickness, and aluminum has been thinned by the same treatment to ten millionths of an inch; but this is the first time two alloys have been reduced to such a thin section by rolling. The feat was achieved by placing the welded strips of alloy between pieces of steel and rolling the complete assembly. The product is not yet manufactured for general sale.

General Electric engineers, working with all the facilities of G-E research laboratories, are daily producing new processes and new applications that make for future progress.

HARD ON THE OX

Residents of Duanesburg in Schenectady county, New York, killed and roasted their plumpest ox recently in order properly to celebrate the opening of the world's longest stretch of sodium-lighted highway. But the ox could feed only a small part of the crowd that turned out to see the sight. Shortly, at a signal picked up by an electric eye, the road glowed out clearly in the darkness. The soft, glareless light of 391 G-E sodium lights made of it a real Golden Road, 18 miles long.

Fifteen thousand people watched the celebration and listened to New York's Commissioner of Highways, Arthur W. Brandt, point out some of the savings that good highway lighting gives. They heard the figures in the case of an early lighting installation made by General Electric—a six-mile section on the well-traveled Albany-Schenectady road. Night accidents have decreased there 40 per cent. Day accidents on the other hand have increased 13 per cent.

These stretches of lighting greatly reduce the hazard in night driving. Another major installation will be opened this fall on the San Francisco-Oakland Bay bridge where 900 units will illuminate both decks of the span. Sodium lighting has been developed to its present efficiency by General Electric engineers.

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GENERAL ELECTRIC